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# ASTEROIDEA OF THE BLUE DOLPHIN EXPEDITIONS TO LABRADOR

By E. H. Grainger

## Introduction

During the four summer field seasons of 1949 to 1952 the *Blue Dolphin* expeditions, commanded by David C. Nutt, collected 321 specimens of sea stars at 57 stations along the coast of Labrador. Eleven species were taken.

Few collections of marine invertebrates from the Labrador coast preceded the *Blue Dolphin* voyages, and little information exists on the invertebrate fauna of the region. Only three publications on asteroid collections from Labrador are available, and they refer to six species in all. Packard (1867) reported from several locations in southern Labrador *Solaster papposus* (Linnaeus), *S. endeca* (Linnaeus), *Henricia sanguinolenta* (O. F. Müller), *Leptasterias groenlandica* (Steenstrup), and *L. polaris* (Müller and Troschel), the latter taken also at Hopedale, about half way along the Labrador coast. Bush (1884) recorded *Solaster papposus*, *Henricia sanguinolenta*, *Leptasterias littoralis* (Stimpson), and *L. polaris*, and Rankin (1901) *L. polaris* only, all from southern Labrador. Packard (1863, 1867) listed *Asterias vulgaris* Verrill from the north shore of the Gulf of St. Lawrence near the Quebec-Labrador boundary. The species, however, has not yet been reported from the Strait of Belle Isle or north of there, and therefore it is not properly a member of the Labrador fauna. The



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*Blue Dolphin* collection raised the number of Labrador species to 13 and extended the range of collections over nearly the full length of the coast.

Two species, *Solaster endeca* (Linnaeus) and *Leptasterias littoralis* (Stimpson), recorded formerly from Labrador, were not included in the *Blue Dolphin* collections. The first is an Arctic, Subarctic, and Boreal species of rock, mud, and sand bottoms, recorded from eastern North America to the Kara Sea and from the Bering Sea and northern Alaska. The second is a Subarctic eastern North American species.

Of the 13 Labrador species considered here, 6 are circumpolar, 5 extend from North America eastward to the northern U.S.S.R. but apparently are absent from the Pacific and from areas immediately on either side of Bering Strait, 1 (in several forms) extends from the North Pacific to western Greenland, and 1 occurs in eastern North America only. Five of the 13 species are Arctic to Boreal in distribution and 8 are Arctic and/or Subarctic.

## Species Collected

The waters of the Labrador Current, which flow southward off the Labrador coast, are of mixed origin, coming partly from west Greenland and partly from east Baffin Island and Hudson Strait. They contain both Arctic and Atlantic elements. Labrador Current water of 50 m. and greater depth shows a temperature range of about −1.70° to nearly 3° C., and a salinity range of 32 to more than 34.5 (Dunbar, 1951). Waters of the coastal inlets of Labrador come primarily from the Labrador Current and may be modified by coastal drainage, according to Nutt (1953). Most of the inlets, including Seven Islands Bay, Hebron Fjord, Kaipokok Inlet, and St. Lewis Inlet, show temperature-salinity characteristics of the lowest temperature and the lowest salinity portion of the Labrador Current, that is, of essentially Arctic-type water with, it appears, relatively little west Greenland influence. Lake Melville and, to a lesser degree, Hamilton Inlet represent more specialized local conditions. Nutt's observations in Hamilton Inlet showed water near the coldest, least saline Labrador Current water in July, but much warmer (more than 0° to more than 2° C.) and slightly reduced in salinity (to less than 31.5°/₀₀) in August. Lake Melville was shown to be much less saline (less than 29°/₀₀) than Hamilton Inlet and about the same temperature.

The echinoderms of the *Blue Dolphin* collection come from two rather different types of environment. One, including all but 2 of the species (*Poraniomorpha tumida* and *Urasterias lincki*) and occurring at the majority of stations, is relatively cold (usually less than 0° C.) below 50 m. but up to about 4° C. at the shallow stations, and not less than

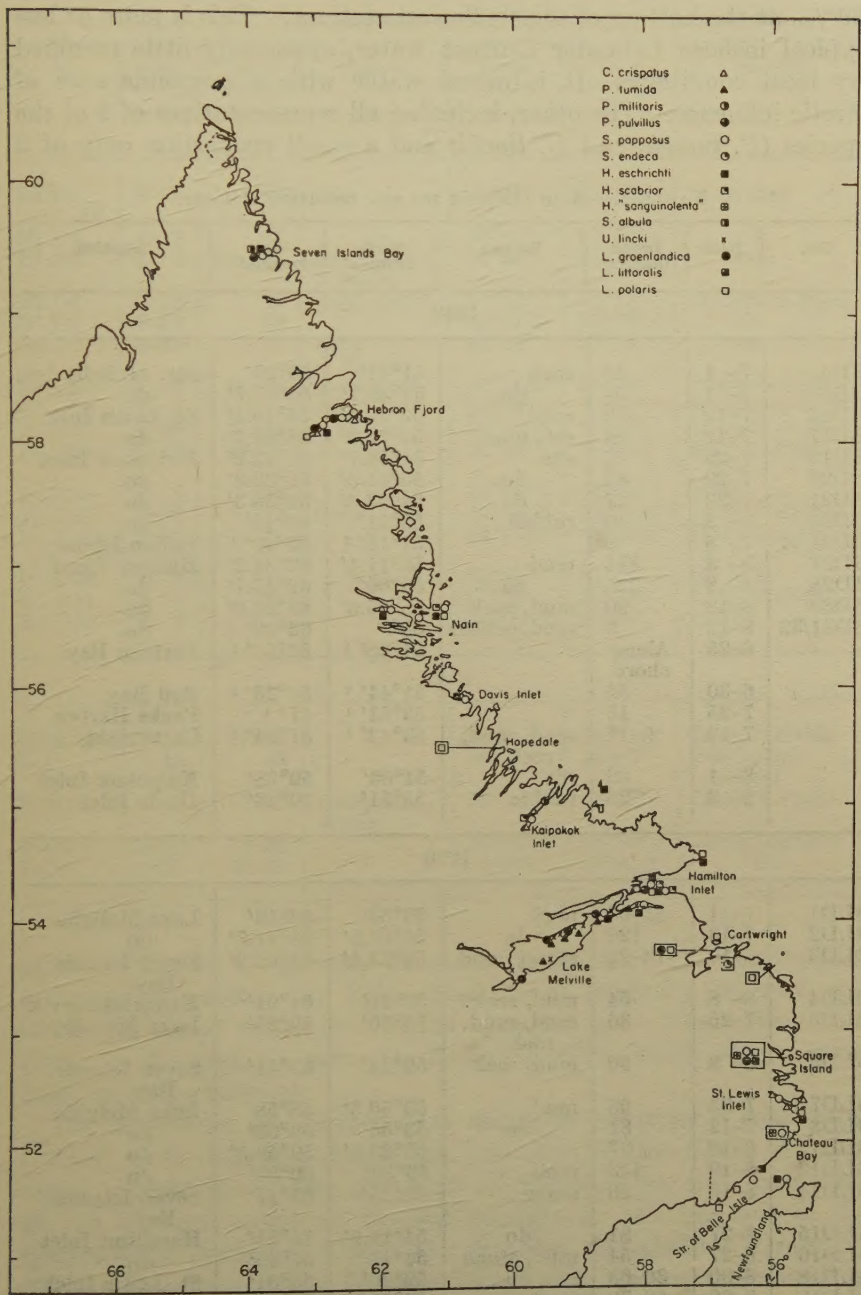


FIGURE 1.—Coast of Labrador, showing *Blue Dolphin* and earlier sea star collection points. Symbols for the latter are enclosed in squares; the other symbols represent *Blue Dolphin* material.

30°/oo at the bottom of the shallowest stations. This is more or less typical inshore Labrador Current water, apparently little modified by local conditions. It is mixed water with a preponderance of Arctic influence. The other, including all representatives of 2 of the species (*P. tumida* and *U. lincki*) and a small proportion only of 3

TABLE 1.—Blue Dolphin *sea star collection stations.*

| No. | Date | Depth (meters) | Bottom | North latitude | West longitude | Location |
|---|---|---|---|---|---|---|
| | | | 1949 | | | |
| BD4 | 7- 1 | 45 | rock | 51°41′ | 56°20′ | Str. of Belle Isle |
| BD5 | 7- 1 | 54 | do | 51°39.7′ | 55°57.7′ | do |
| BD16 | 7-12 | 72 | mud | 52°20.1′ | 55°49.4′ | St. Lewis Inlet |
| BD17 | 7-12 | 64 | soft mud | 52°22.3′ | 55°56.7′ | do |
| BD19 | 7-29 | 82 | silt | 54°56.7′ | 59°43.2′ | Kaipokok Inlet |
| BD20 | 7-29 | 82 | do | 55°01.5′ | 59°33.3′ | do |
| BD21 | 7-29 | 27 | do | 54°52.4′ | 59°50.3′ | do |
| BD24 | 8- 3 | 40 | rubble | 55°51′ | 60°15′ | do |
| BD24/37 | 7- 8 | 0 | | 51°16′ [1] | 55°40′ [1] | Indian Island |
| BD27 | 8- 8 | 174 | mud | 58°11.4′ | 62°34.2′ | Hebron Fjord |
| BD28 | 8- 8 | 225 | do | 58°09′ | 62°45.7′ | do |
| BD30 | 8-12 | 90 | mud, rock | 58°05.6′ | 63°03.9′ | do |
| BD31/32 | 8-12 | 9 | sand, pebble | 50° [1] | 63°20′ [1] | do |
| | 6-25 | Along shore | | 51°28′ [1] | 56°54′ [1] | Forteau Bay |
| | 6-30 | 55 | | 51°44′ [1] | 56°25′ [1] | Red Bay |
| | 7-25 | 15 | | 53°51′ [1] | 57° [1] | Packs Harbor |
| | 7-19 | 9-11 | sand, mud, rock | 53°42′ [1] | 57°04′ [1] | Cartwright |
| | 8- 1 | 82 | silt | 54°56′ | 59°38′ | Kaipokok Inlet |
| | 8- 3 | 20 | rubble | 55°51′ | 60°48′ | Davis Inlet |
| | | | 1950 | | | |
| BLD1 | 7-11 | 54-63 | mud | 53°52′ | 59°19′ | Lake Melville |
| BLD2 | 7-13 | 126 | do | 54°01.3′ | 58°41.7′ | do |
| BLD3 | 8-10 | 18-22 | stone, mud | 59°23.4′ | 64°03.2′ | Seven Islands Bay |
| BLD4 | 8- 8 | 54 | mud, rock | 59°24′ | 64°01′ | Kangalaksiorvik |
| BLD5 | 7-25 | 36 | sand, mud, rock | 53°50′ | 59°25′ | Lake Melville |
| BLD6 | 8- 8 | 90 | mud, rock | 59°24′ | 63°51′ | Seven Islands Bay |
| BLD7 | 7-23 | 63 | mud | 53°56.5′ | 58°58′ | Lake Melville |
| BLD8 | 7-12 | 81 | do | 53°56′ | 59°03′ | do |
| BLD11 | 8-19 | 27 | | 53°28.8′ | 59°59.5′ | do |
| BLD12 | 8-19 | 113 | mud | 53°32′ | 60°03′ | do |
| BLD14 | 8-10 | 90 | stone | 59°25′ | 63°47′ | Seven Islands Bay |
| BLD15 | 8-27 | 81 | do | 54°14.9′ | 58°01′ | Hamilton Inlet |
| BLD16 | 8-27 | 54 | mud, stone | 54°15′ | 57°45′ | do |
| BLD18 | 8-30 | 36-63 | do | 52°20′ | 55°51′ | St. Lewis Inlet |
| BLD19 | 8-30 | 63-72 | mud | 52°21′ | 55°56.5′ | do |
| BLD20 | 7-28 | 16-20 | do | 53°29′ | 59°58′ | Lake Melville |
| BLD22 | 8-30 | 18 | mud, stone, shell | 52°20′ [1] | 56° [1] | St. Lewis Inlet |

TABLE 1.—Blue Dolphin *sea star collection stations*—Continued

| No. | Date | Depth (meters) | Bottom | North latitude | West longitude | Location |
|---|---|---|---|---|---|---|
| | | | 1951 | | | |
| BLD1, 11, 34 | 8– 7 | 63 | mud | 56°36′ [1] | 61°50′ [1] | Nain Bay |
| BLD2 | 8– 7 | 81 | do | 56°36′ [1] | 61°50′ [1] | do |
| BLD3 | 8– 5 | 99–108 | sandy mud, stone | 56°33′ [1] | 61°40′ [1] | off Nain |
| BLD4 | 7–29 | 18 | mud, rock | 54°33′ [1] | 57°12′ [1] | Hamilton Inlet |
| BLD5 | 7–22 | 88 | | 54°14.8′ | 57°59′.5 | do |
| BLD7 | 8–24 | 63 | hard (?rock) | 54°22′ | 57°39′ | do |
| BLD8 | 7– 2 | 27–36 | mud, rock | 52°12.5′ | 55°43′ | Niger Sound |
| BLD10 | 7– 5 | 27 | rock | 54°20′ [1] | 57°30′ [1] | Hamilton Inlet |
| BLD23 | 8–26 | 31–34 | | 53°40′ [1] | 59°30′ [1] | Lake Melville |
| BLD35 | 7–29 | 18–27 | | 54°33′ | 57°10′ | Brig Harbour Isle |
| BLD36 | 8– 8 | 110 | | 56°33′ [1] | 61°40′ [1] | Nain |
| BLD37 | 7–10 | 72 | mud | 53°30.8′ | 59°59.6′ | Lake Melville |
| BLD19/39 | 7–22 | 36 | | 54°15.8′ | 58°01.5′ | Hamilton Inlet |
| BLD40 | 8– 8 | 110 | | 56°33′ [1] | 61°40′ [1] | off Nain |
| BLD41 | 8–25 | 146 | | 53°39′ | 59°30′ | Lake Melville |
| BLD44 | 8– 6 | 73 | | 56°33′ [1] | 61°40′ [1] | Nain |
| | | | 1952 | | | |
| I–2a, b | 7– 4 | 27–29 | | 54°6.3′ | 58°01.1′ | Lake Melville |
| I–4 | 7–13 | 85 | | 55°7′ | 58°45′ | Ironbound Sound |
| I–11 | 7–31 | 13–15 | mud, sand, stones | 58°10′ [1] | 62°40′ [1] | Hebron Fjord |
| I–16 | 8–24 | 30–36 | | 53°40′ [1] | 59°30′ [1] | Lake Melville |
| I–17 | 8–25 | 29–36 | | 54°6.3′ | 58°01.1′ | do |

[1] Approximate.

others (*Solaster papposus*, *Henricia eschrichti*, and *Leptasterias groenlandica*) occurs in Lake Melville in generally warmer and much less saline water (not higher than 29°/oo). These two situations are bridged, in part, by Hamilton Inlet which shows intermediate characteristics.

The Asteroidea of Labrador are therefore primarily a cold water (mixed Arctic-Atlantic) fauna characteristic of the North Atlantic region, closely resembling, although considerably less rich than, that of the warmer waters of western Greenland. All but one of the species occur in Canadian waters to the north of Labrador (Grainger, 1955). The exception is *Leptasterias littoralis*, the northern limit of which appears to be the Labrador coast. *Asterias vulgaris* may be shown to reach southernmost Labrador in the Strait of Belle Isle, but it is doubtful that it reaches farther northward. All but one of the species also occur to the south of Labrador in the cold inshore waters

of the Canadian Atlantic provinces and New England. *Poraniomorpha tumida* appears not to have been recorded south of the Labrador location given here. Others, like *Pteraster pulvillus* and *Henricia scabrior*, are evidently rare south of Labrador.

Comparison of this material with Pettibone's (1956) report on the *Blue Dolphin* polychaetes from Labrador illustrates interesting distributional differences between the generally widely dispersed polychaete species and the more restricted sea stars. Of 68 species of polychaetes, only 9% (compared with 62% of the asteroids) are Arctic-Subarctic and 37% (38% of the asteroids) are Arctic-to-Boreal; the remainder, including 25% with "cosmopolitan" distribution, show no counterpart among the sea stars.

I am grateful to Dr. F. M. Bayer of the United States National Museum for making the *Blue Dolphin* collection available for study and to Mr. D. C. Nutt for providing station data.

Locations of all collection stations are shown in figure 1. The *Blue Dolphin* station list is given in table 1.

### *Ctenodiscus crispatus* (Retzius)

*Asterias crispata* Retzius, 1805, p. 17.
*Ctenodiscus crispatus* (Retzius).—Fisher, 1911, p. 31, pls. 3 (figs. 1–4), 4 (figs 1–6).

Collected at 9 stations; 27 to 174 m.; mud, silt, rock; 1949: BD16 (47 specimens), BD17 (1), BD19 (14), BD21 (4), BD27 (4), BD30 (1); 1950: BLD18 (10), BLD19 (23); 1951: BLD1, 11, 34 (13).

All but 4 individuals have the usual 5 rays; 3 from BD16 and 1 from BD21 have only 4. Two 5-rayed individuals show apparently regenerating rays, 1 with a single new ray, the other with 2. Diameters range from 6 to 78 mm., the majority being larger than 30 mm.

These specimens were collected (fig. 1) between Hebron and St. Lewis Inlet, and the species may be expected to occur along the full length of the Labrador coast. It is limited here to cold water of high salinity (fig. 2), to water of −1° C. and less, and of a little less than 31°/oo to 33°/oo. Typically a mud-bottom form, it occurred almost exclusively on mud in these collections. It is a circumpolar species, ranging from Arctic to Boreal seas.

### *Poraniomorpha tumida* (Stuxberg)

*Solaster tumida* Stuxberg, 1878, p. 31, pl. 6.
*Asterina tumida tuberculata* Danielssen and Koren, 1884, p. 63, pls. 10 (figs. 5–7), 15 (fig. 3).
*Paraniomorpha tumida* (Stuxberg).—Mortenson, 1910, pp. 257–258, pl. 16 (figs. 6, 7).

Collected at 8 stations: 27–146 m.; mud, sand, rock; 1950: BLD1 (4 specimens), BLD2 (3), BLD5 (4), BLD7 (2), BLD8 (2); 1951: BLD41 (2); 1952: I–2a, b (3), I–17 (2).

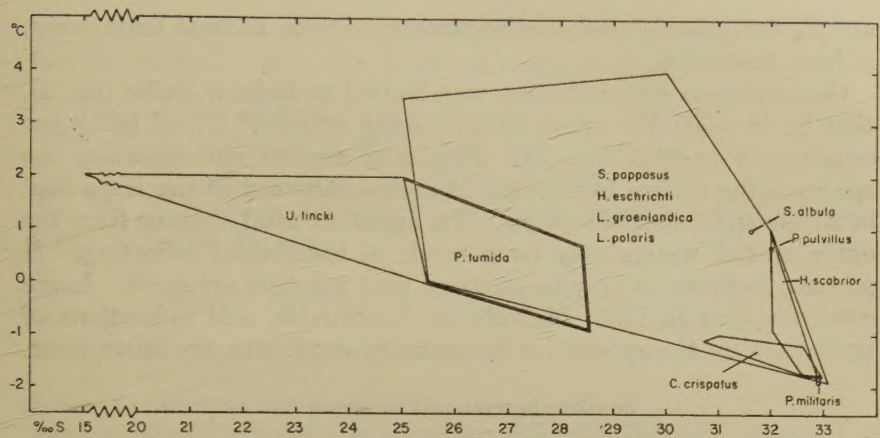


FIGURE 2.—Temperature-salinity ranges of the *Blue Dolphin* sea star specimens.

All the specimens show at least some characteristics of the form *tuberculata* Danielssen and Koren, described as differing from *tumida* in having relatively longer rays, in possessing dorsal tubercles, and in having only single rather than double rows of adambulacral spines. Arm radii are from 9 to 36 mm., R:r from 1.7:1 to 2.7:1. Dorsal tubercles, present in all, vary greatly in their degree of development, from only faint bulges to strongly developed protuberances spread conspicuously over the dorsal surface. There is some evidence of correlation between size and tubercle development, the largest sea stars frequently showing the most highly developed tubercles. Adambulacral spines show a rather bewildering range of variation, most being arranged in only a single row but many occurring in 2 rows per plate. One-row series range from 3 to 5, having most frequently 4 or 5 per plate. The majority of specimens show both 1-row and 2-row adambulacral plates, usually irregularly arranged, the latter with up to 8 spines per plate. While there appears to be some correlation between size and degree of development (above), there is none apparent between either size and R:r values or between size and adambulacral spine arrangement; that is, large specimens with well-developed dorsal tubercles (characteristic of form *tuberculata*) may have low R:r values and frequent occurrence of 2 rows of spines per adambulacral plate (characteristic of *tumida*). Little work on variation within either form has been done to date. It appears from this collection that form *tuberculata* must be defined much more widely than was done by Danielssen and Koren, and that its differences from the stem form are far less distinct than they were formerly thought to be. Possession of dorsal tubercles and presence of only a single row of spines on the majority of adambulacral plates

are the two criteria used here to place specimens, at least tentatively, in form *tuberculata*.

Occurrence in this collection was limited to Lake Melville (fig. 1), that is, to relatively warm water, mostly above 0° C., of fairly low salinity, 25 to 28.5 (fig. 2). This is a curious circumstance, the species being known from North America eastward to the Kara Sea, in Arctic and Subarctic waters. Its apparent total absence from the outer coastal waters may be a result of insufficient collecting. If present, however, it may be assumed that numbers are small. Large concentrations in Lake Melville are undeniable, and indications of preference by the species for low salinity conditions are fairly clear.

### *Solaster papposus* (Linnaeus)

*Asterias papposa* Linnaeus, 1767, p. 1098.
*Solaster papposus* (Linnaeus).—Fisher, 1911, p. 325, pl. 94 (figs. 1–6).

Collected at 24 stations; 13 to 225 m.; mud, rock, rubble; 1949: BD4 (1 specimen), BD5 (2), BD16 (8), BD24 (1), BD28 (1), BD30 (7), Davis Inlet (4); 1950: BLD3 (2), BLD4 (1), BLD14 (1), BLD15 (1), BLD16 (3), BLD18 (2), BLD19 (1), BLD22 (2); 1951: BLD1, 11, 34 (2), BLD3 (2), BLD5 (1), BLD19/39 (3), BLD40 (1), BLD44 (2); 1952: I–2a, b (1), I–11 (1), I–16 (2).

These specimens range in diameter from 7 to 176 mm. and have from 9 to 13 rays. More than half (53%) have 12 rays. It is the most abundantly collected asteroid on the Labrador coast (fig. 1), as indeed it appears to be throughout most of the eastern Arctic-Subarctic part of the North American coast. Temperature-salinity tolerance is wide (fig. 2), from nearly −2° to 4° C., and from about 25‰ to 33‰. Most collections are from the outer Labrador coast; a few specimens were taken, however, in the outermost reaches of Lake Melville. It is a circumpolar species, ranging from Arctic to Boreal waters.

### *Pteraster militaris* (O. F. Müller)

*Asterias militaris* O. F. Müller, 1776, p. 234.
*Pteraster militaris* (O. F. Müller).—M. Sars, 1861, p. 48, pls. 3 (figs. 8, 9) 4, 5, 6 (figs. 1–13).

Collected at 3 stations; 82 to 108 m.; silt, sandy mud, stone. 1949: BD20 (1 specimen), Kaipokok Inlet (1); 1951: BLD3 (1).

The 3 individuals, 148, 118, and 70 mm. in diameter, show R:r values of 2.4:1, 2.6:1, and 2.3:1 respectively. They are rather unexceptional members of this widely distributed nearly circumpolar, Arctic, Subarctic and Boreal species. Occurrence here (fig. 1) is limited to two locations which (fig. 2) have high salinity of nearly 33 and low temperature of near −2° C.

### *Pteraster pulvillus* M. Sars

*Pteraster pulvillus* M. Sars, 1861, p. 62, pls. 6 (figs. 4–18), 7, 8.

Collected at 1 station; 81 m.; stone; 1950: BLD15 (1 specimen). The single individual collected was 44 mm. in diameter, with R:r of 1.7:1. It occurred (fig. 1) in Hamilton Inlet, at 0.7° C. and 32°/₀₀ (fig. 2). This too is an almost circumpolar species, extending from Arctic to Boreal Waters.

### *Henricia eschrichti eschrichti* (Müller and Troschel)

FIGURE 3

*Eschinaster eschrichtii* Müller and Troschel, 1842, p. 25.
*Henricia eschrichti eschrichti* (Müller and Troschel).—Heding, 1935, p. 26, figs. 8, 12(2), 13(7, 8, 12–14).

Collected at 14 stations; 18 to 146 m.; mud, rock, rubble; 1949: BD5 (2 specimens), BD30 (1), Red Bay (2), Davis Inlet (1); 1950: BLD15 (1); 1951: BLD1,11,34 (1), BLD4 (1), BLD5 (1), BLD7 (1), BLD8 (1), BLD40 (1); 1952: I–2a, b (2), I–4 (1), I–16 (2).

Several of these 18 specimens are placed with some doubt in the form *eschrichti*. Inconsistencies among the deviating forms and the suggestion of gradations between typical *eschrichti* and the most variable specimens, however, prompt inclusion of all within the *eschrichti* group. The majority fulfill requirements of the form according to the criteria of Heding (1935) and Djakonov (1950) and agree well with specimens from farther north in Arctic-Subarctic Canada (Grainger, 1955). One individual, from BLD4 (1951), taken by itself, however, shows several marked differences from typical *eschrichti*. The diameter is 60 mm., the R:r 4.3:1. Dorsal paxillae are more widely separated than in the typical form, often by spaces equal to their width or larger. A few paxillae have up to 12 to 14 spines; others have as few as 3. Many have 4 to 6. The madreporite shows conspicuous rows of spines. Most important are the adambulacral spines, generally in only a single row, or sometimes in irregular zigzag series suggesting 2 rows, with always a single spine larger than the others at the edge of the groove (figs. 3*c*,*d*). These spines usually number 5 or 6 per plate. Marginal paxillae differ from typical *eschrichti* in their shape. Instead of being roughly circular to oval, they are clearly elongate and form obvious, rather comblike structures transversely along the marginal area (fig. 3*d*).

This subspecies brings to mind Verrill's (1894) *Cribrella pectinata* from Eastport, Maine, later (Verrill, 1914) placed as a variety of *Henricia sanguinolenta* following the finding of intermediate forms. This specimen resembles *pectinata* in having dorsal paxillae separated

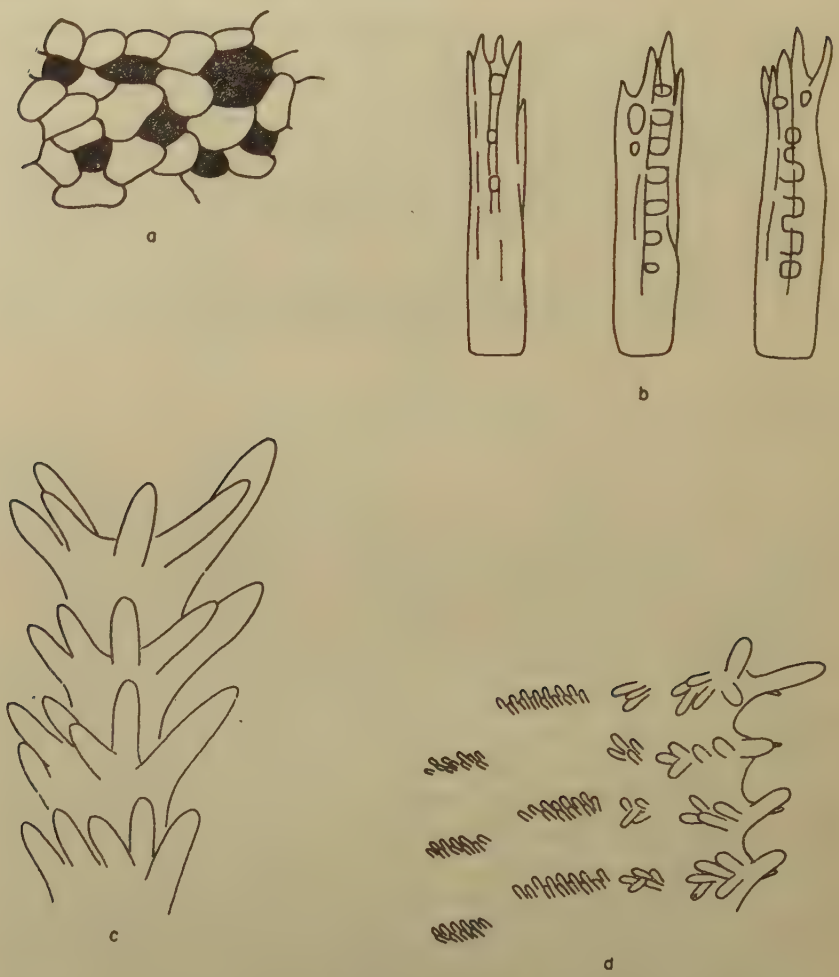


FIGURE 3.—*Henricia eschrichti:* *a,* aboral ray plates; *b,* aboral ray spines; *c,* adambulacral spines, showing variable 1-row pattern; *d,* adambulacral and marginal spines, showing comblike arrangement of the marginals.

by spaces equal to their own diameter or larger, transverse combs of spines on the marginal plates, with the inframarginals the larger, madreporite with obvious rows of spines, occasionally 2 rows of blunt adambulacral spines per plate, and almost always a single spine (the largest one of the series) at the upper edge of the adambulacral groove. It differs from *pectinata* in having some dorsal paxillae with as many as 12 to 14 spines, most inframarginal plates with fewer than 20 spines, and adambulacral plates usually with only 5 or 6 (rather than 8 to 12) spines in only 1 row or in irregular zigzag rows. The last feature probably is the most important—compare figure 3

with Verrill (1914, pl. 49, fig. 1a). This specimen closely resembles *Cribrella pectinata* but is not identical with it, nor does the specimen seem to be a distinct form by itself. Examination of other specimens shows wide variation in marginal comb structure, with forms intermediate between the advanced comb noted above and the typical *eschrichti* comb. Spacing of the dorsal paxillae varies between the open pattern above and the fairly close arrangement characteristic of *eschrichti*. Adambulacral spines frequently show 2 rows per plate, with either a single large spine at the upper edge of the groove or, as in typical *eschrichti*, 2 more or less equally large spines at the groove margin. One specimen shows all structures except the marginal combs closely resembling the extreme form described above. The marginal spines are typical for *eschrichti*. In others the characteristics are blended differently. It seems impossible, therefore, to set these specimens up as a distinct form; rather they must be considered merely as variations of the form *eschrichti*.

Specimens in this collection (fig. 1) were taken all along the Labrador coast from Seven Islands Bay to the Strait of Belle Isle and from the outermost portion of Lake Melville. The ranges of temperature and salinity (nearly −2° to 4° C. and 25 to 33°/₀₀) are wide. The range of form *eschrichti* cannot yet be described because of the doubtful identity of many former records of *Henricia sanguinolenta*, including two from southern Labrador shown in figure 1. The form *eschrichti* appears to be primarily Subarctic and Arctic, and it extends from the Barents Sea westward at least to eastern North America and southward at least to the coast of New England.

### *Henricia scabrior* (Mikhaĭlovskiĭ)

FIGURE 4

*Cribella sanguinolenta* forma *scabrior* Mikhaĭlovskiĭ, 1902, pp. 478–480.
*Henricia scabrior* (Mikhaĭlovskiĭ).—Heding, 1935, p. 31, fig. 11, 12(5, 6), 13 (9–11).—Djakonov, 1950, p. 92, pls. 44, 45.

Collected at 6 stations; 36 to 110 m.; silt, mud, rock; 1949: BD19 (3 specimens), Kaipokok Inlet (1); 1950: BLD15 (1), BLD16 (1); 1951: BLD19/39 (1), BLD40 (1).

Among only 8 individuals there is considerable structural variation. This species is obviously one of the more plastic of this extremely variable genus. Heding (1935) expanded somewhat on Mikhaĭlovskiĭ's (1903) original description of the species. Much greater variability was shown by Djakonov (1950), and it is on the basis of his concept of the species that the individuals of the present collection are placed in *H. scabrior*; this assignment is made with awareness that further collecting may show subspecific separations which present material is not sufficiently extensive to reveal.

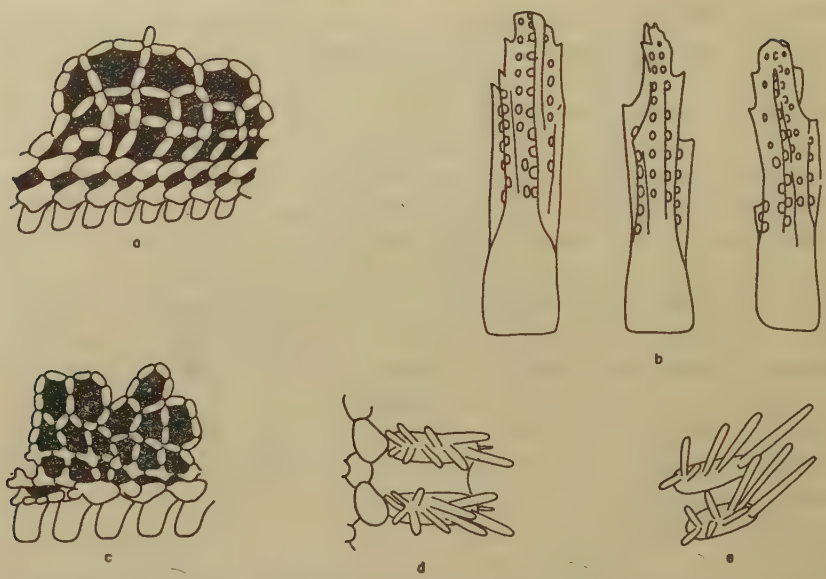


FIGURE 4.—*Henricia scabrior:* *a*, lateral ray plates; *b*, aboral ray spines; *c*, lateral ray plates; *d* and *e*, adambulacral spines.

The most variable features of the species are the arrangement of the plates on the side of the ray adjacent to the adambulacrals and the adambulacral spines. Frequently 1 or 2 longitudinal rows of plates occur fairly regularly along the ventrolateral surface of of the ray, parallel to the adambulacral plates. Dorsal to these, quite irregular papular spaces are enclosed by a variable arrangement of plates, and occasionally single isolated plates occur within the papular areas (figs. 4*a*,*c*). Adambulacral spines are frequently present as a single row of about 6 per plate (fig. 4*e*), but may be more numerous (up to 12 per plate), may occur in an irregular zigzag pattern, and may often resemble 2 rows per plate (fig. 4*d*). Both patterns may occur in single individuals. Dorsally, a membrane characteristically covers single spines per plate, but there may be at least 4 per plate. Spines lack the terminal crown of points characteristic of *H. eschrichti;* lateral ridges do not extend higher than the central portion of the spine (fig. 4*b*). One specimen with exceptionally slender rays showed unusually small papular areas and relatively more slender spines than do other individuals.

Specimens were collected (fig. 1) from Nain to Hamilton Inlet; these are the first published records of the species from Canadian waters. With a temperature range of nearly −1.8° to 1° C. and a salinity range of 32 to nearly 33 (fig. 2), the species is limited here to an environment of high salinity, and relatively low temperature. It

appears to be an Arctic and Subarctic species. From Labrador and Foxe Basin in eastern Canada, it is known as far to the east as the New Siberian Islands. Additional specimens of the species have been identified by the author from the Gulf of St. Lawrence and south of Newfoundland.

### *Stephanasterias albula* (Stimpson)

*Asteracanthion albulus* Stimpson, 1853, p. 14, pl. 1, fig. 5.
*Stichaster albilus* (Stimpson).—Mortensen, 1910, p. 267, pls. 13 (figs. 1–6), 14 (fig. 8), 15 (figs. 8–10), 17 (fig. 12).
*Stephanasterias albula* (Stimpson).—Fisher, 1930, pp. 157–159, pls. 70 (figs. 1–5), 71 (figs. 1, 1a–g), 72 (fig. 5).

Collected at 1 station; 18 to 22 m.; rock, mud; 1950: BLD3 (2 specimens).

The 2 individuals collected in Seven Islands Bay (fig. 1) are 42 and 31 mm. in diameter, the larger having 6 unequal rays, the smaller 3 equal rays. Temperature was 1° C., salinity 31.6 (fig. 2). Arctic and Subarctic in distribution, the species is recorded from eastern Canada eastward to the Kara Sea, and in the Bering Sea, Sea of Okhotsk, and Sea of Japan. It is not known in North America from west of Foxe Basin and Jones Sound nor in northern Asia from between the Bering and Kara Seas.

### *Urasterias linckii* (Müller and Troschel)

*Asteracanthion linckii* Müller and Troschel, 1842, p. 18.
*Asterias gunneri* Danielssen and Koren, 1884, p. 7, pls. 2, 3 (figs. 8, 9).
*Asterias stellionura* Danielssen and Koren, 1884, p. 14, pl. 4 (figs. 1–9).
*Urasterias linckii* (Müller and Troschel).—Fisher, 1930, p. 211.

Collected at 12 stations; 27 to 146 m.; mud, rock; 1950: BLD1 (16 specimens), BLD2 (3), BLD5 (7), BLD7 (4), BLD8 (2), BLD12 (2), BLD20 (2); 1951: BLD23 (1), BLD37 (3), BLD41 (4); 1952: I–2a, b (6), I–17 (2).

These individuals range in diameter from 20 to 330 mm., in R:r from 4.3:1 to 8.5:1. The specimens in this collection were taken only from Lake Melville (fig. 1); none were taken along the outer coast. Figure 2 shows temperatures mostly above 0° C. and reaching 2° C., and salinities from 15 to only 28.5. In this collection the species is restricted to low salinity and intermediate temperatures.

Almost circumpolar, although not recorded from between Herschel Island (near the Alaskan-Yukon boundary) and the eastern Siberian Sea, it is an Arctic-Subarctic species. Because the species occurs elsewhere in higher salinity than here, its apparent absence from the outer Labrador coast is difficult to explain. It appears to be a species of wide salinity tolerance, perhaps especially well adapted to low

salinity where it occurs in greatest abundance, at least in eastern North America.

### *Leptasterias groenlandica* (Steenstrup)

*Asteracanthion groenlandicus* Steenstrup, 1857, p. 228.
*Leptasterias groenlandica* (Lütkin).—Fisher, 1930, pp. 45–47, pls. 8 (figs. 1–3), 21–23, 24 (figs. 1, 2).

Collected at 9 stations; 9 to 225 m.; mud, sand, rock; 1949: BD28 (17 specimens), BD30 (1), Cartwright (1); 1950: BLD3 (5), BLD5 (2), BLD8 (?1), BLD11 (2); 1951: BLD4 (1); 1952: I–16 (1).

Diameter range is from (?10) 20 to 110 mm., R:r from 3.1:1 to 5.8:1. The majority at least appear to be of the form *groenlandica* (Steenstrup). Distinction between the forms *groenlandica* and *cribraria* (Stimpson) is frequently not clear in individual specimens, and generally is not indicated in publications. Range of the 2 forms, therefore, is not known in detail. It is possibly significant, however, that the majority of specimens reported by Grainger (1955) from the eastern Arctic area immediately to the north of Labrador were called *cribraria*.

One small individual of diameter 10 mm., R:r 5.5:1 could not be identified with certainty. Another specimen of diameter 41 mm., R:r 3.5:1 (station BLD4, July 29, 1951), enclosed 62 young stars beneath its rays held in the brooding position.

The species was collected at stations along the whole length of the Labrador coast (fig. 1), including 2 stations just within Lake Melville. It was found (fig. 2) over a wide temperature range (less than −1° to 4° C.) and a fairly wide salinity range (about 25°/₀₀ to 33°/₀₀). It is a circumpolar species of Arctic and Subarctic waters.

### *Leptasterias polaris* (Müller and Troschel)

*Asteracanthion polaris* Müller and Troschel, 1842, p. 16.
*Leptasterias polaris* (Müller and Troschel).—Fisher, 1930, p. 60, pls. 30 (figs. 1, 2), 32 (fig. 3), 35.

Collected at 10 stations; intertidal zone to 110 m.; rock, pebble sand, mud; 1949: BD24/37 (1 specimen), BD31/32 (1), Forteau Bay (1), Packs Harbour (1), Cartwright (3); 1951: BLD4 (1), BLD10 (1), BLD19/39 (1), BLD35 (1), BLD36 (1).

Diameters are from 25 to 270 mm., R:r from 3.7:1 to 5.2:1. Specimens were taken from Hebron to the Strait of Belle Isle (fig. 1), under temperature and salinity conditions similar to those of *L. groenlandica* (fig. 2). The species was not taken within Lake Melville but was found immediately outside. An inhabitant of Arctic and Subarctic waters, it is reported (in its various subspecific forms) from the New Siberian Islands eastward only to West Greenland.

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